



~~**Fleet Numerical Meteorology & Oceanography Center**~~

Command Overview

This briefing is UNCLASSIFIED / FOUO

10 March 2010

LT Angela Lefler
Operations Department





Watch Presence

- Global and 24x7
 - Coordinates and provides support for all time sensitive METOC RFIs
- Fleet Ops Reachback
 - Tailored Products: AREPS, TAWS, Staff Daily Briefs, Northern WX, Evaporative duct's for COMSUBFOR, MOCC VP det
 - Other Support: USSTRATCOM, NOPF Whidbey, NSW MSC, Special Support Pages, JMFU/CMFU supporting C2X/JTFEX
 - Supporting forward SGOTs and METs as required
- ISR Reachback (Strike component)
 - TAM and JFCC ISR
- Submarine Weather (SUBWEAX) Direct Support

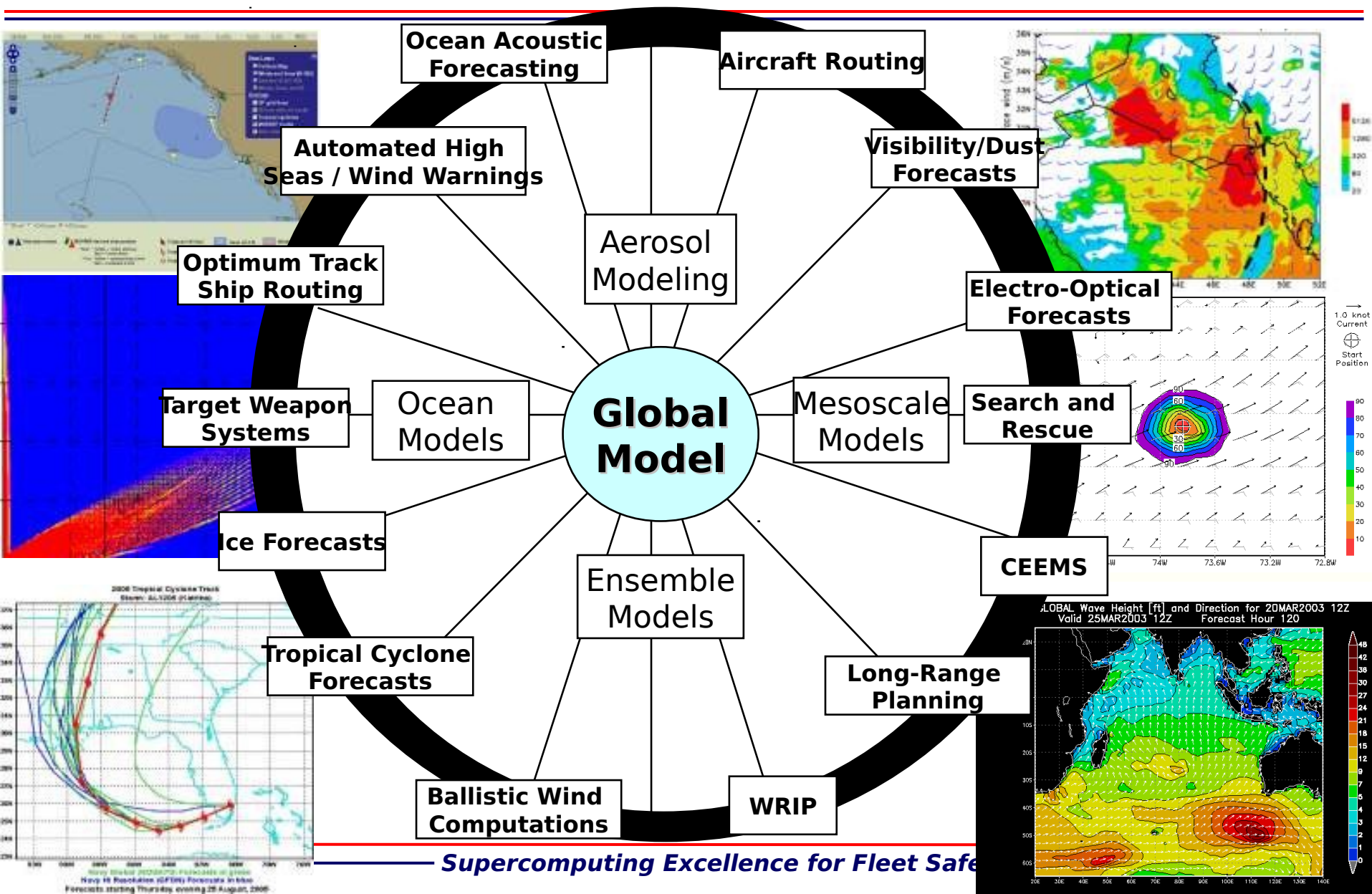


Models Overview

- **NOGAPS** – Navy Operational Global Atmospheric Prediction System; T319L42 global spectral model, at the center of FNMOC production.
- **COAMPS/CAAPS** – Coupled Ocean/Atmosphere Mesoscale Prediction System; regional mesoscale model, multi-nested to ~2 km resolution within NOGAPS.
- **NAVDAS** – Navy Atmospheric Variational Data Assimilation System; 3D-VAR data assimilation for NOGAPS and COAMPS. **NAVDAS-AR** 4D-VAR Weak Constraint now operational.
- **GFDN** – Navy implementation of the GFDL TC model; only moveable-nest TC model operational in all ocean basins (critical part of 4-member CONW and 5-member CONU for extended TC forecasts). Nested within NOGAPS.
- **WW3** – WaveWatch III spectral ocean wave model; global and regional implementations, driven by NOGAPS and COAMPS.
- **EFS** – NOGAPS-based global 18-member 10-day Ensemble Forecast System (part of NAEFS and JEFS collaborations); includes 18-member global WW3 ensemble.
- **NAAPS** – Navy Atmospheric Aerosol Prediction System; only operational global aerosol model. Atmospheric optical properties output feeds Target Acquisition Weapons Software (TAWS). Driven by NOGAPS.



Models and Applications



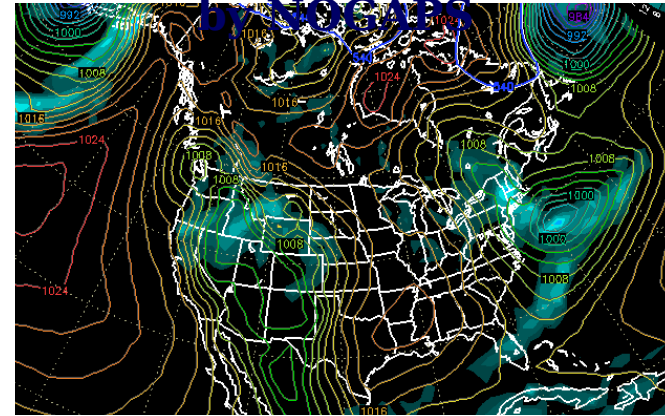


Navy Operational Global Atmospheric Prediction System

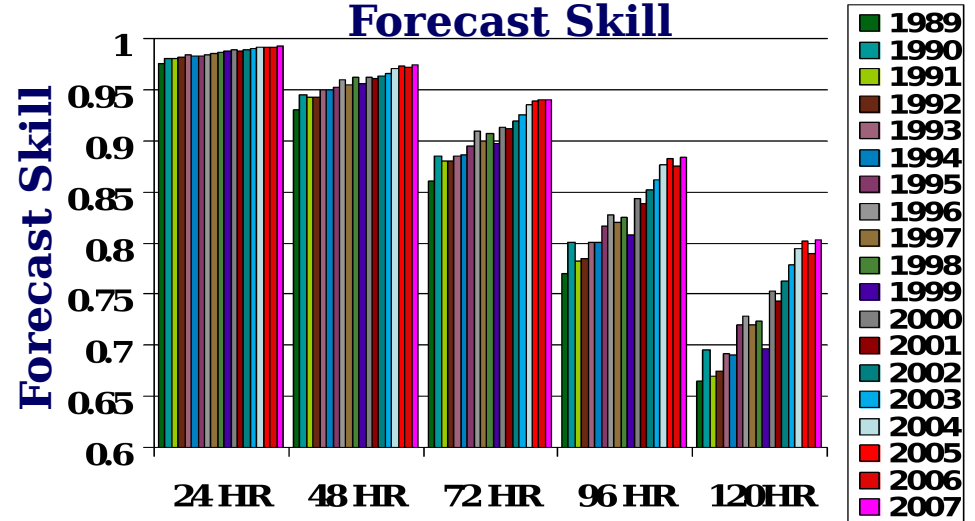
NOGAPS:

- Global spectral model
- Only global weather model protected to DoD Information Assurance (IA) standards
- Run 4 times per day with forecasts to 180 hours
- Provides lateral boundary conditions for COAMPS/COAMPS-OS
- Was the leading tropical cyclone track forecast model in the world for 2006
- Developed and supported by NRL

Surface Pressure and Clouds Predicted by NOGAPS



Improvement of NOGAPS Forecast Skill



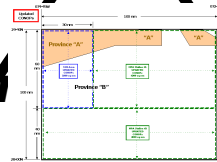


Battlespace On Demand

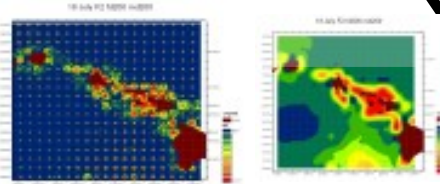
Forecast Battlespace

Tier 3 - the Decision Layer

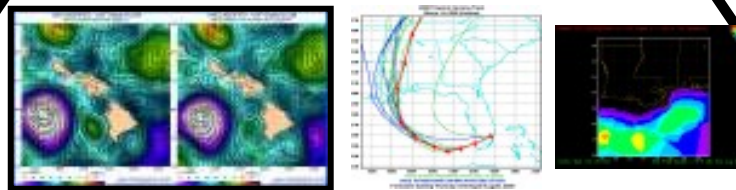
- **Options / Courses of Action**
- **Search Patterns**
- **Asset Allocation / Timing**
- **Quantify Risk**



Tier 2 - the Performance Layer



Tier 1 - the (forecast) Environment Layer



Initial and Boundary Conditions



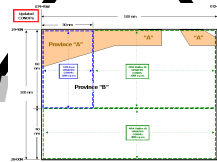


Battlespace On Demand

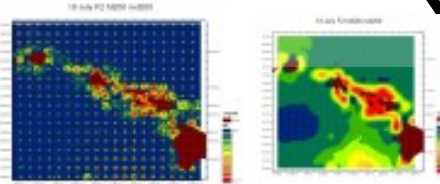
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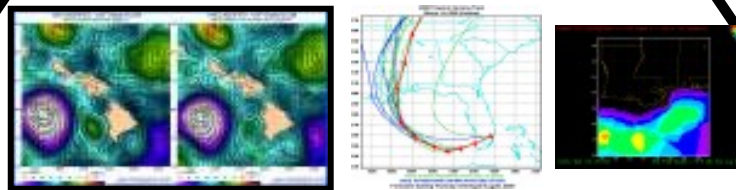
- Options / Courses of Action
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Tier 2 - the Performance Layer



Tier 1 - the (forecast) Environment Layer



Initial and Boundary Conditions

**Model
Products
Smart
Climatology
Satellite
Products**



Regional Capabilities

Centralized Atmospheric Analysis and Prediction System (CAAPS)

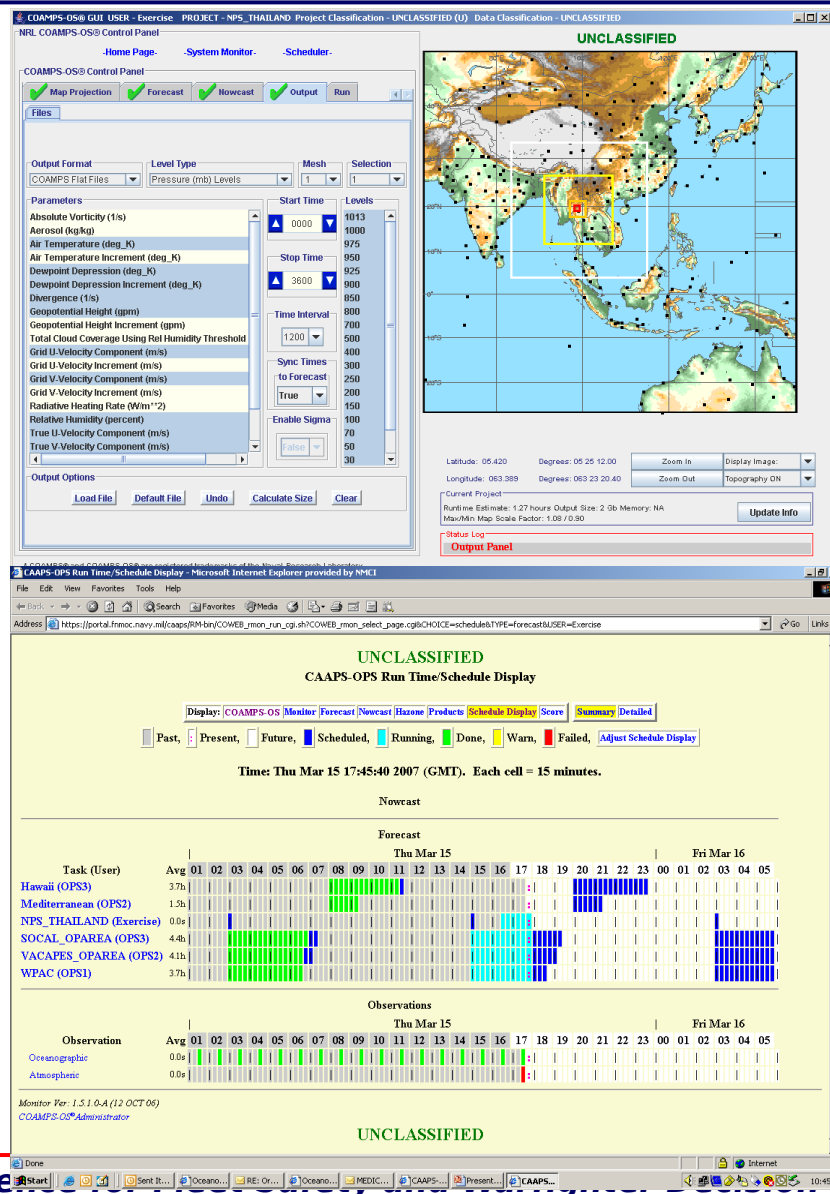
- CAAPS is a relocatable, higher-resolution modeling implementation of COAMPS-OS [Linux Cluster based]
 - User configurable areas and model resolutions
- Rapid area implementation permits repositioning in near real-time to support critical Naval operations
- Incorporates a Vapor-Liquid-Solid (VLS) Track Dispersion Model for WMD plume forecasts
- Multiple CAAPS areas currently running to support classified Naval and Joint operations

S delivers on-demand support within 20 minutes



COAMPS On Scene

- Local-scale on-demand implementation of COAMPS via the Centralized Atmospheric Analysis and Prediction System (CAAPS)
- Rapid and on-demand initiation of high-resolution multi-nested model runs down to a ~1 km resolution
- Fully integrated with the VLSTrack atmospheric transport and dispersion model
- Soon to include coupled ocean models (WW3, SWAN, NCOM)
- With HPC capability added to the SCIF, we now have TS level of high-res. model support





COAMPS-OS Specialized Products

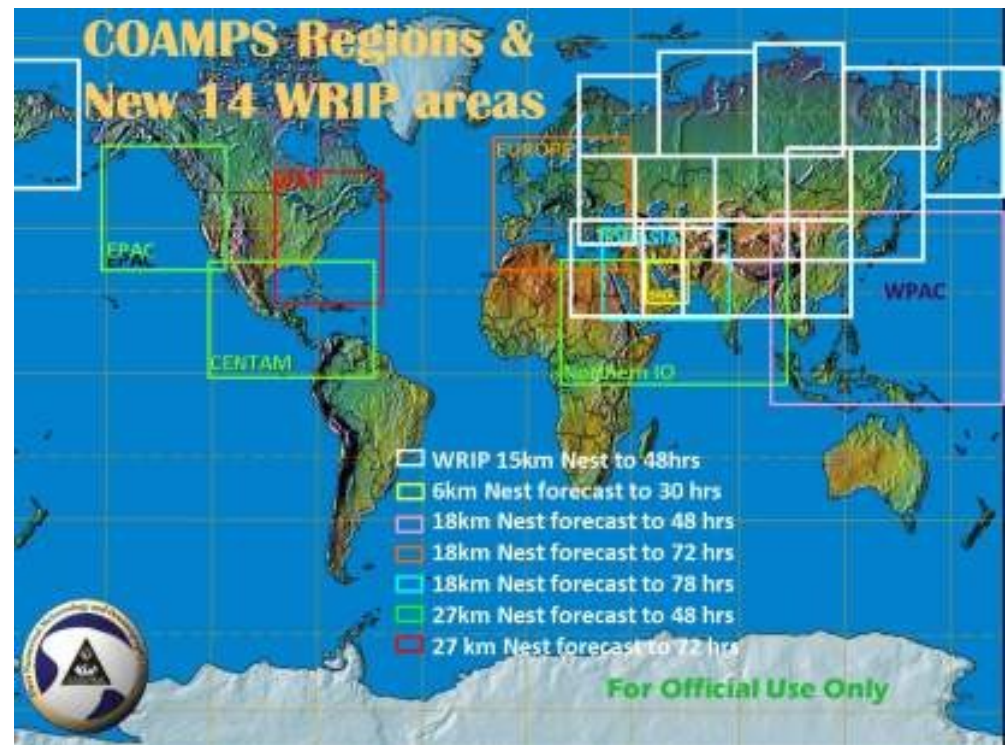
Weather Reaction Interactive Planning (WRIP) Tool

Specialized products related to both the vertical distribution and particle-size distribution of water are required for the WRIP planning tool.

This required original R&D by NRL and operational production and distribution of unique parameters.

Operational support of WRIP parameters available from all COAMPS areas on Opal.

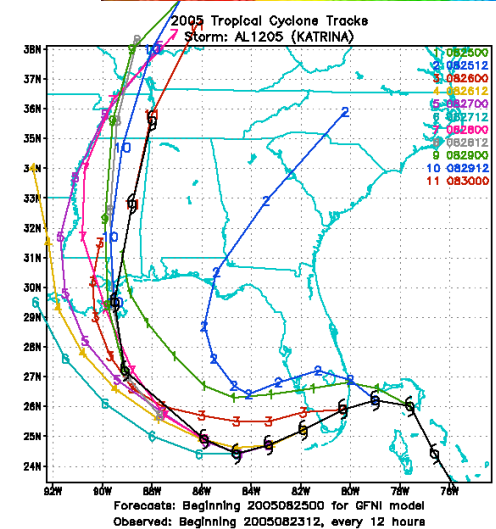
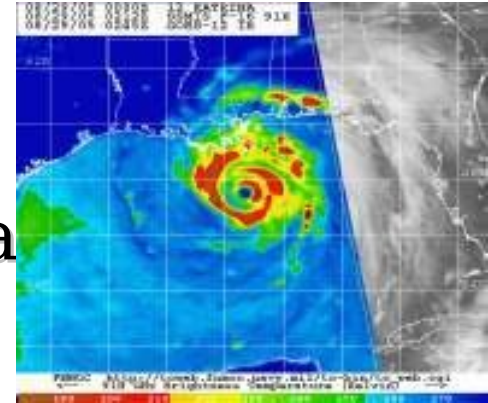
2x/daily 48hr forecasts @ 00 & 12Z for the 14 WRIP areas





GFDN

- Navy's version of the Geophysical Fluid Dynamics Lab tropical cyclone model
- GFDN is run for tropical cyclones in a basin
- Uses NOGAPS lateral boundary vice GFS fields used by GFDL
- Two nested configuration
 - 75°x75° fixed outer nest at 1/2°
 - 11°x11° moving inner nest at 1/6°
- 42 vertical sigma levels



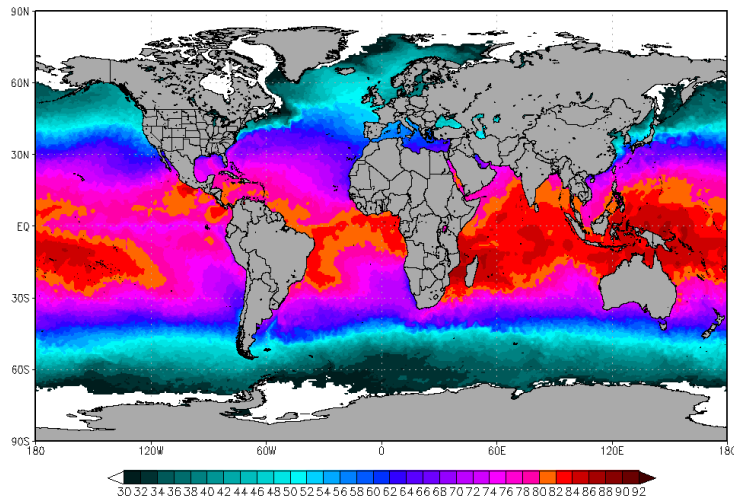


NCODA

Navy Coupled Ocean Data Assimilation

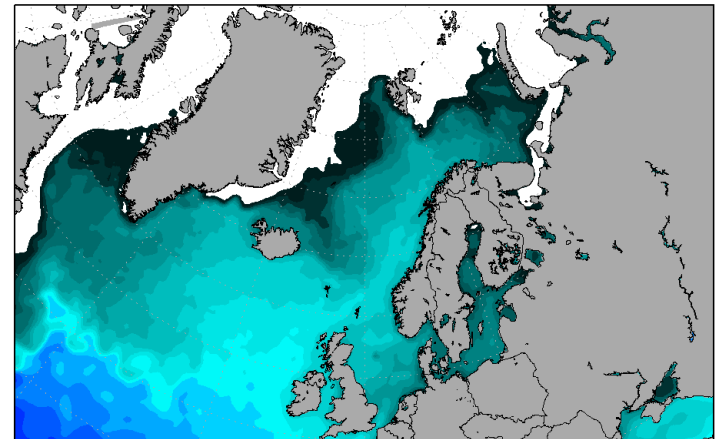
- Provides sea boundary conditions to COAMPS and NOGAPS
- 3D Ocean Analysis based on Multi-Variant Optimum Interpolation (MVOI) technique
- Computes SST, ice concentration, and 3-D temperature and salinity analyses
- Part of Analysis/Forecast cycle with WW3 to assimilate satellite wave height data
- Current back-up and future replacement for MODAS

GLOBAL Sea Surface Temperature [F] Analysis
VT 12Z02FEB2009



NCODA 1440x721 .25 degree data provided by FNMOC, Monterey, CA
GRADS graphics by D.J. Laws FNMOC dennis.laws@navy.mil (global)

GIN_SEA Sea Surface Temperature [F] Analysis
VT 12Z02FEB2009

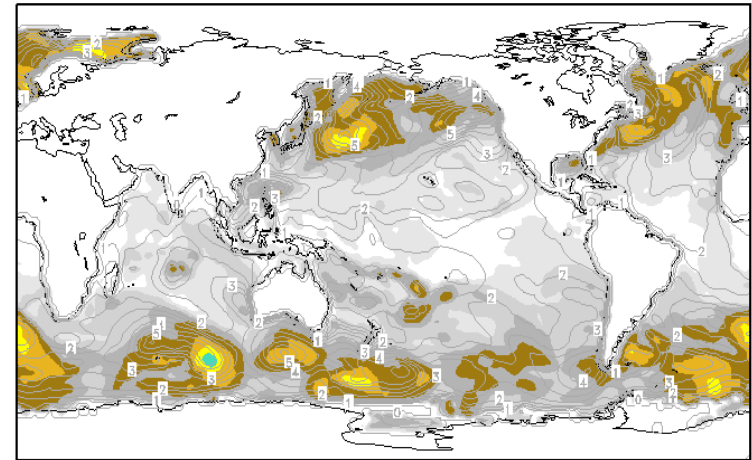


NCODA 1440x721 .25 degree data provided by FNMOC, Monterey, CA
GRADS graphics by D.J. Laws FNMOC dennis.laws@navy.mil (gin sea)



WAVEWATCH III (WW3)

- Recent Upgrades
 - Running under OPS control on A2 Linux Cluster
 - Implemented WW3 v3.12 on A2
- Planned Upgrades
 - Implement WW3 v3.14, including assimilation of wave height data from satellite altimeters, on A2 (FY09)
 - Create a joint global WW3 ensemble with NCEP, assembled at FNMOC (FY09)
 - Interactive “virtual buoy” wave forecast bulletins on SIPR/JWICS (FY09)
 - Integrated WW3 into COAMPS-OS v2.0 (FY09)



potential error (+/-), 95% confidence interval
ensemble mean (m)

Significant Wave Height

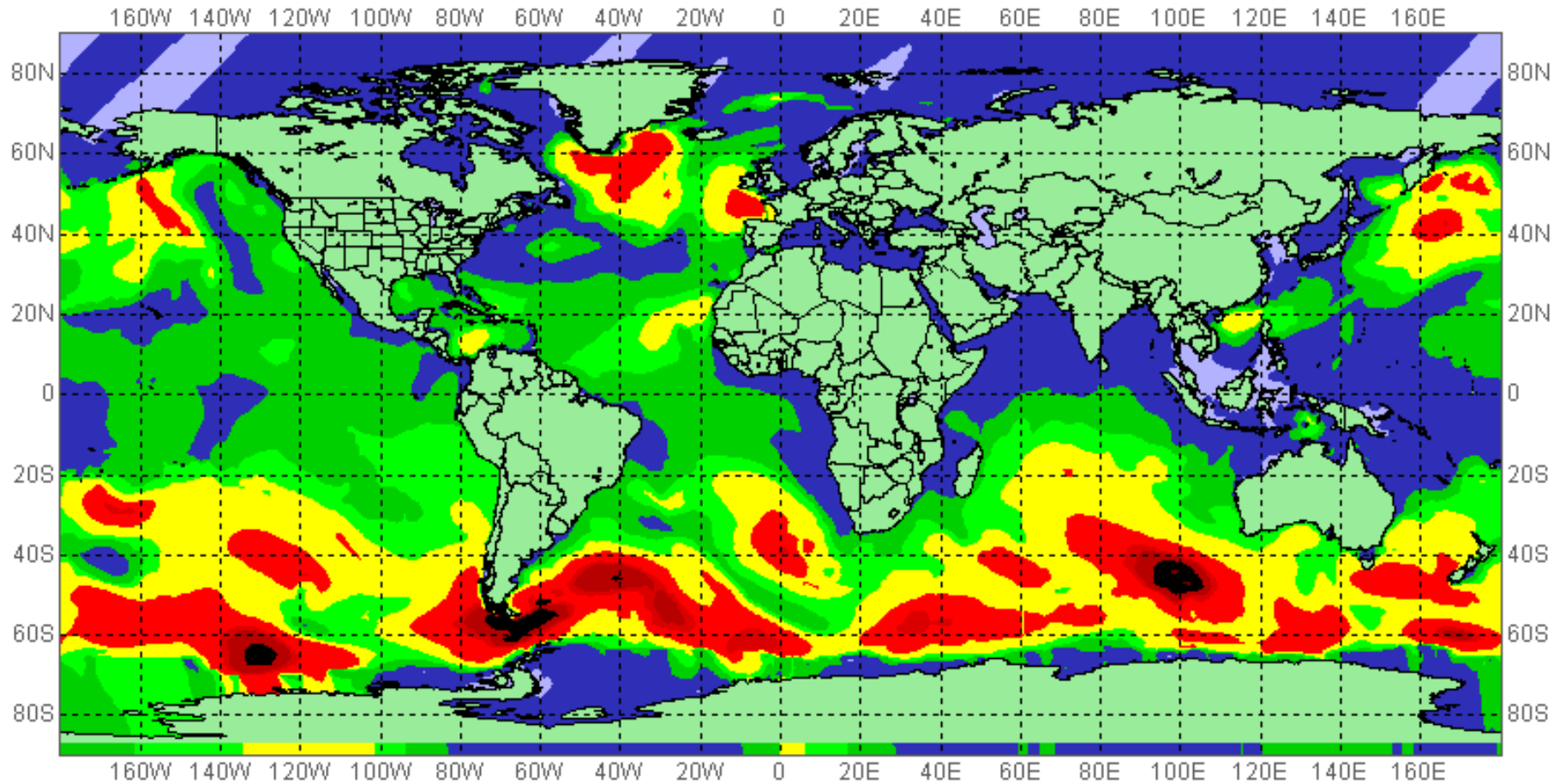
NOGAPS: 05 JAN 09 00Z
48 hr forecast valid 07 JAN 09 00Z

New WW3 Ensemble Global Wave
Height Mean and Variability
graphic



WAVEWATCH III (WW3)

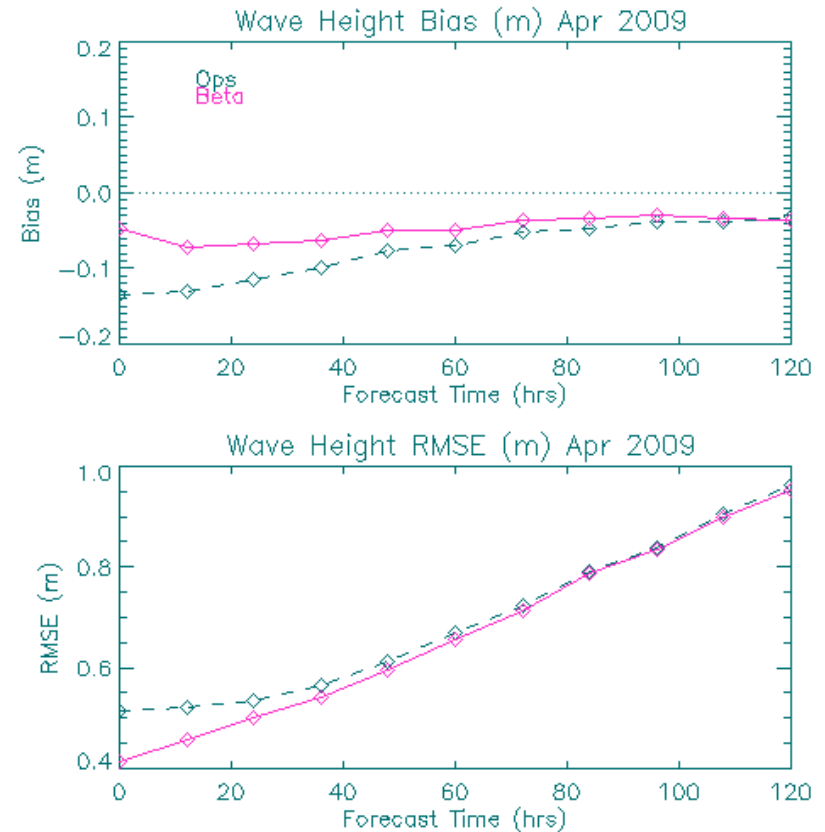
☒ SIGNIFICANT WAVE HEIGHT WW3 GLOBAL (Feet) 12 Hr. Fcst. Valid 28APR2009 1200Z





WAVEWATCH III (WW3)

- Recent Improvements
 - Operational implementation of Wave Data Assimilation [Sep 09]
- Plans
 - Create a joint global WW3 ensemble with NCEP, assembled at FNMOC [FY10]





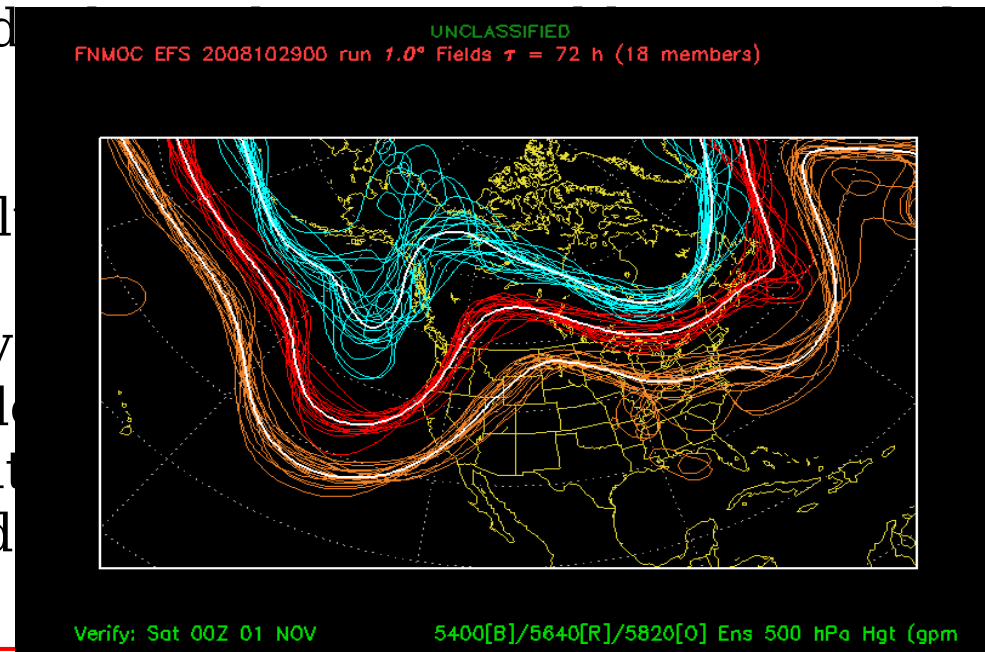
-
- Figure 1 is a line graph titled "FNMOC EFS Sea Level Pressure [hPa] at nlmofo-c-new-london Initial DTG 00Z01AUG2002". The Y-axis is labeled "Pressure (hPa)" and ranges from 988 to 1044 in increments of 4. The X-axis is labeled "Forecast Date" and shows dates from 1 AUG 2002 to 11 AUG. The graph displays multiple colored lines representing different forecast models. The pressure generally increases from around 1010 hPa on August 1st to a peak of approximately 1026 hPa around August 3rd, then fluctuates between 1012 hPa and 1028 hPa until August 11th.





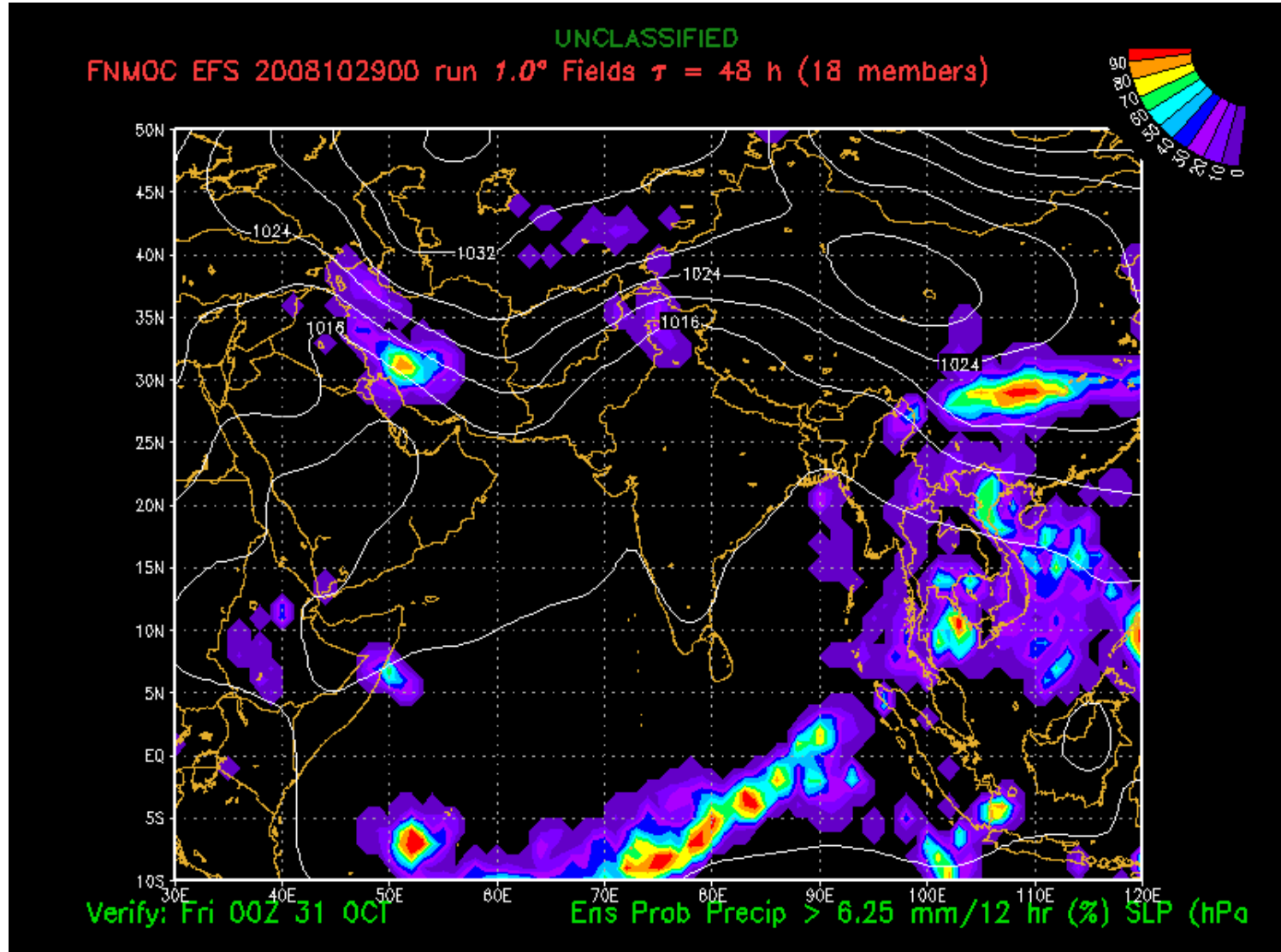
Ensemble Forecast System (EFS)

- 18 NOGAPS forecasts at approximately 1-degree resolution and 30 vertical levels (T119L30)
- Forecast period: 0 to 240 hours at 6 hr intervals, run once per day at 00Z
- Grids available through CAGIPS at approx 0530Z (include parameter values for individual gale wind probability)
- Web graphical products include
 - gale wind probability
 - precipitation probability
 - spaghetti plots, plume plots
 - ensemble mean temperature
 - 500 mb height mean and standard deviation



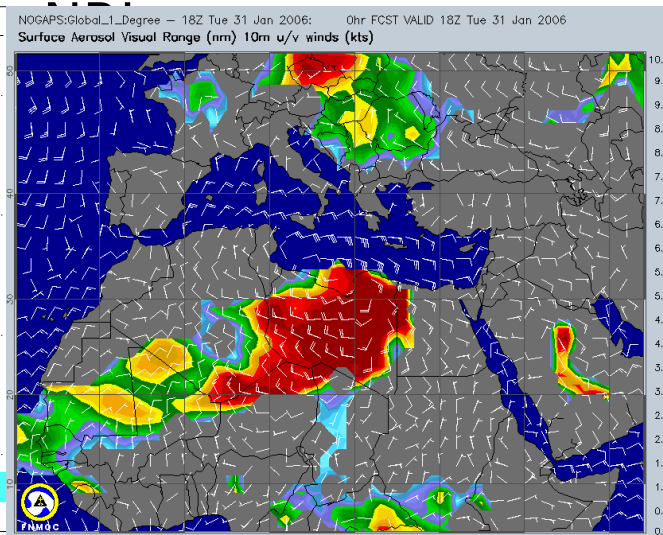
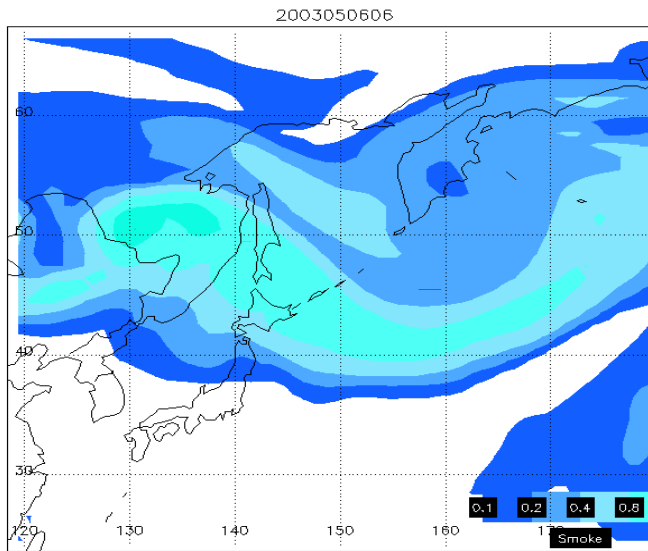


Ensemble Probability Plot





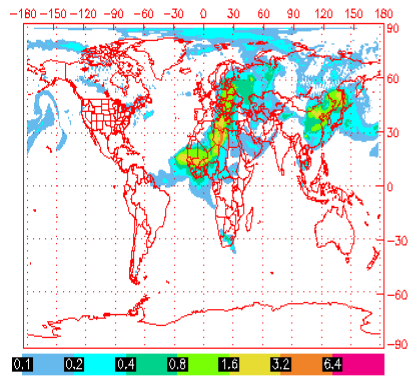
- Global atmospheric aerosol prediction system
- Includes smoke, dust, sea salt, sulfate, volcanic
- Use real-time data streams
- Driven by NOGAPS
- Provides direct feed to the Forecast of Atmospheric and Optical Radiative Properties (FAROP) and the Target Acquisition Weather Software (TAWS) for BonD Tier 2 Applications
- Dev



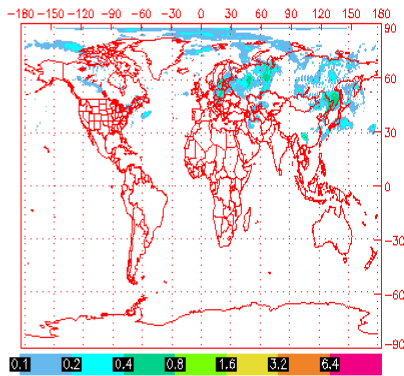


NAAPS Specialized Products

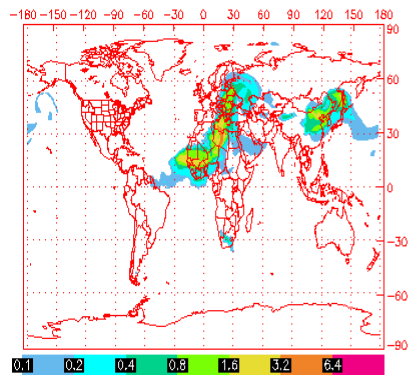
NAAPS Total Optical Depth for 12:00Z 22 Jan 2009
Contoured at 0.1, 0.2, 0.4, 0.8 etc.



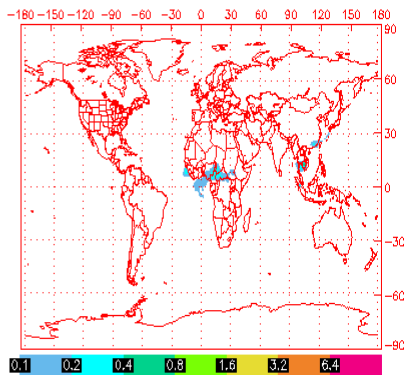
NAAPS Sulfate Optical Depth for 12:00Z 22 Jan 2009
Contoured at 0.1, 0.2, 0.4, 0.8 etc.



NAAPS Dust Optical Depth for 12:00Z 22 Jan 2009
Contoured at 0.1, 0.2, 0.4, 0.8 etc.



NAAPS Smoke Optical Depth for 12:00Z 22 Jan 2009
Contoured at 0.1, 0.2, 0.4, 0.8 etc.



Jan 22 08:32:19 2009 NRL/Monterey Aerosol Modeling

Extinction Coefficient @ 0.3 μm
Extinction Coefficient @ 0.55 μm
Extinction Coefficient @ 1.06 μm
Extinction Coefficient @ 3-5 μm (band-averaged)
Extinction Coefficient @ 8-12 μm (band-averaged)
Scattering Coefficient @ 0.3 μm
Scattering Coefficient @ 0.55 μm
Scattering Coefficient @ 1.06 μm
Asymmetry Parameter @ 0.3 μm
Asymmetry Parameter @ 0.55 μm
Asymmetry Parameter @ 1.06 μm
Phase Function @ 0.3 μm [Phase 2]
Phase Function @ 0.55 μm [Phase 2]
Phase Function @ 1.06 μm [Phase 2]

Target Acquisition Weapons Software



Weapons sensor-specific lock
in ranges displayed in

FalconView

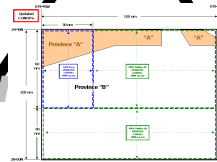


Battlespace On Demand

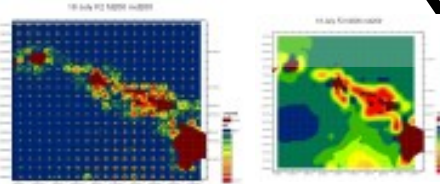
Forecast Battlespace

Tier 3 - the Decision Layer

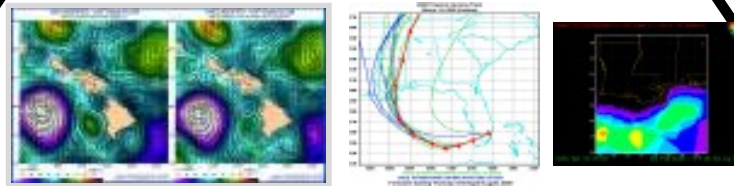
- Options / Courses of Action
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Tier 2 - the Performance Layer



Tier 1 - the (forecast) Environment Layer



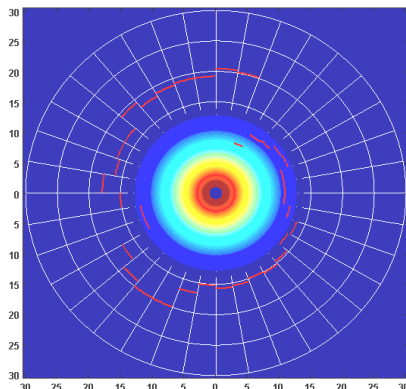
Initial and Boundary Conditions

**Visualization
of METOC
Impacts**

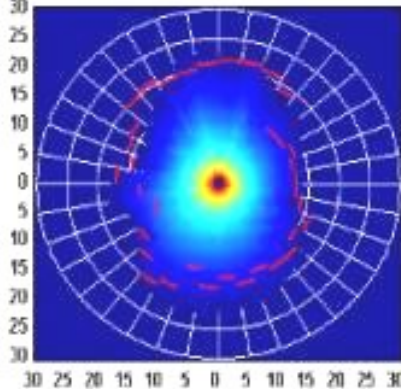


Tier 2 Applications

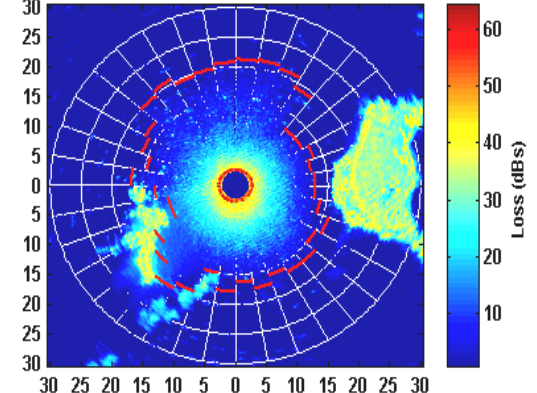
- AREPS (Advanced Refractive Effects Prediction System)
- Target Acquisition Weather Software (TAWS)
- FAROP (Forecast of Atmos. and Optical Radiative Properties)
- ATCF (Automated Tropical Cyclone Forecast System)
- APS (Atmospheric Performance Surface)
- EVIS (Example of Radar Performance Prediction)



Climatology



Model Predicted (AREPS



Observed

(AREPS plus

driven by COAMPS and
WW3)

Supercomputing Excellence for Fleet Safety and Warfighter Decision Sup

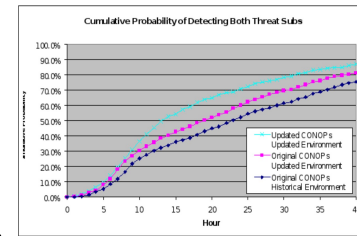
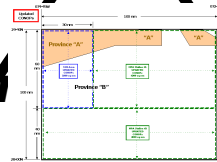


Battlespace On Demand

Forecast Battlespace

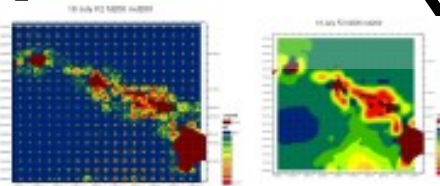
Tier 3 - the Decision Layer

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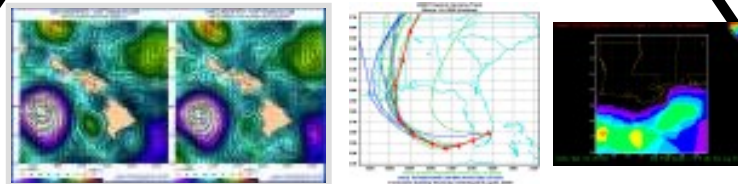


**Tactical
Decision
Aids (TDAs)**

Tier 2 - the Performance Layer



Tier 1 - the (forecast) Environment Layer



Initial and Boundary Conditions



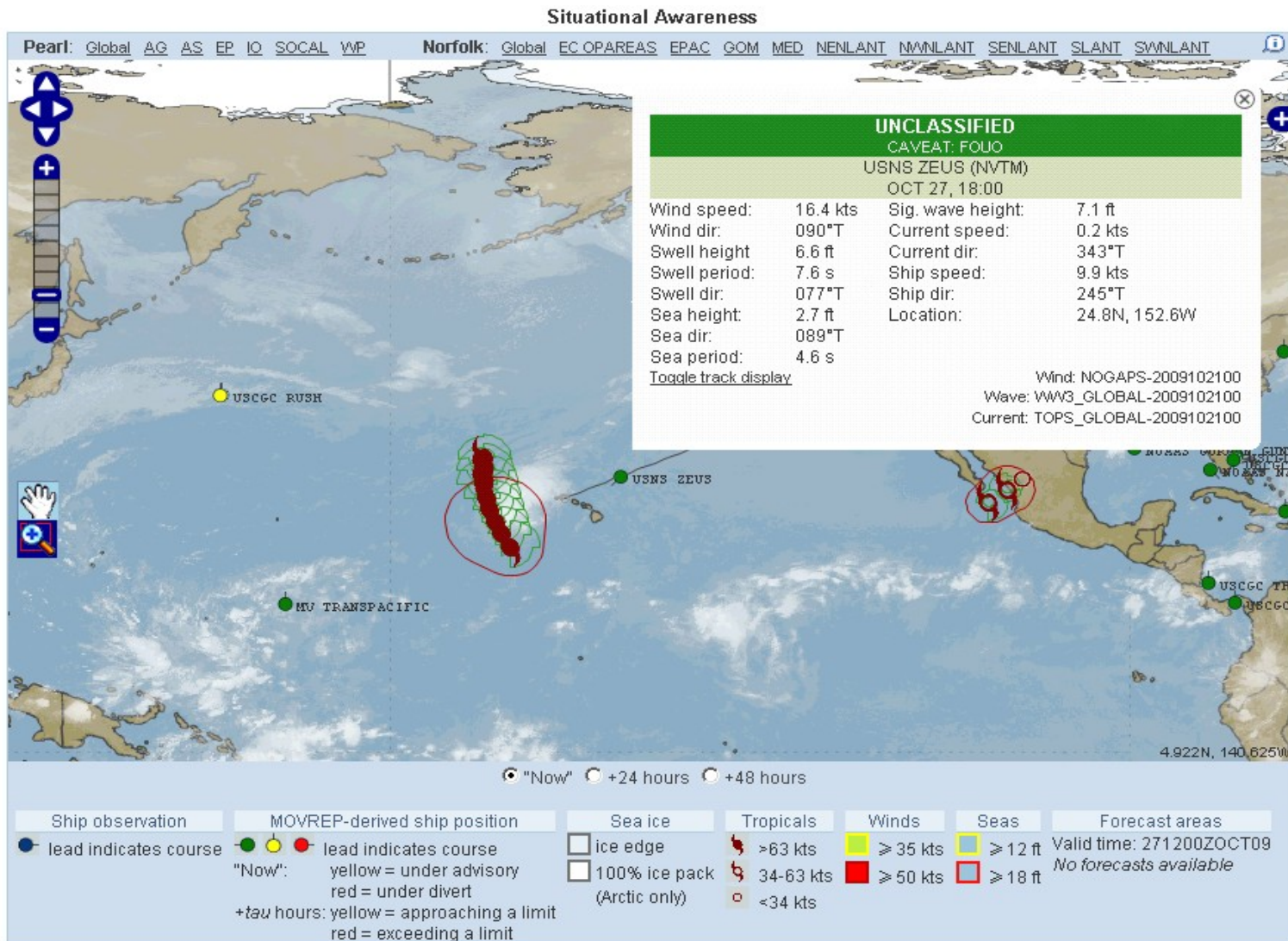
-
- UNCLASSIFIED**
- | | |
|-------------------|----------------|
| Name: | 6208 |
| Latitude: | 33.770°N |
| Longitude: | -118.170°W |
| Munipity (#): | 1 |
| Range: | |
| Region: | |
| Sig Agent ID: | |
| COAGP(0) | |
| Dose DTG(Tau): | 200706000 / 18 |
| Attack Date/Time: | 20 Jun 2007 |
| Local DTG: | 0700 1000 |
| Map Time: | Reference hour |
| Map Contour: | |
| Coverage Level: | |
| Map Units: | |
| N/E Neutry (km) | |
| x(0.0 - 0.0) | Red |
| x(0.0 - 1.0) | Orange |
| x(1.0 - 99.0) | Yellow |
| x(99.0 - 100.0) | Green |
- UNCLASSIFIED**
- Dosage at 10 meters above ground cover
COAGP(0) is a registered trademark of the Naval Research Laboratory





UNCLASSIFIED//FOUO

A-OTSR

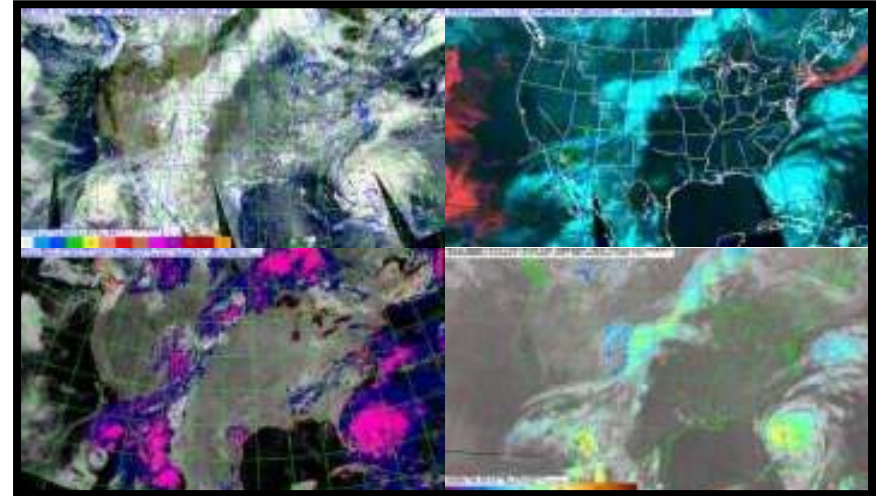


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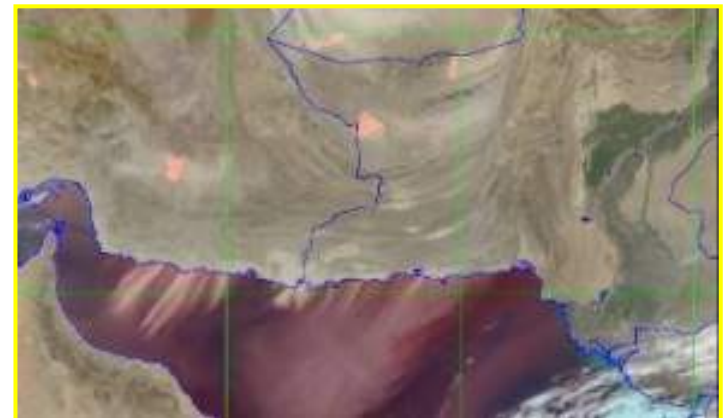


SATFOCUS

- FNMOC produces a wide variety of on-demand satellite imagery products from meteorological satellites (including NASA platforms)
- Complements the CAAPS/COAMPS-OS on-demand modeling capability
- Includes unique capability to pull out dust plumes from Moderate Resolution Imaging Spectroradiometer (MODIS) imagery
- Developed and supported by NRL



Example SATFOCUS Products

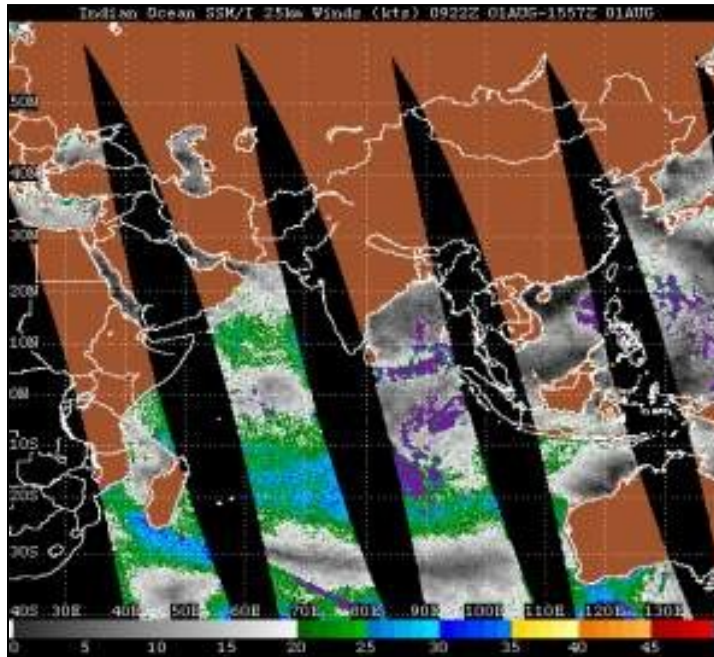


SATFOCUS Dust Enhancement

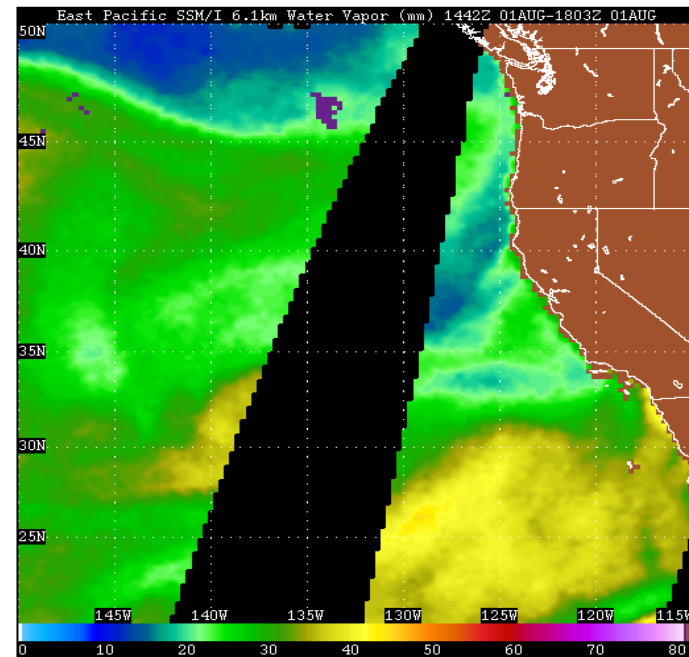


SSM/I and SSMI/S Products

- FNMOC serves as the primary national production facility for SSMI and SSMI/S products
- Important supporting data set for NWP models and maritime forecasters



SSM/I Wind Speed

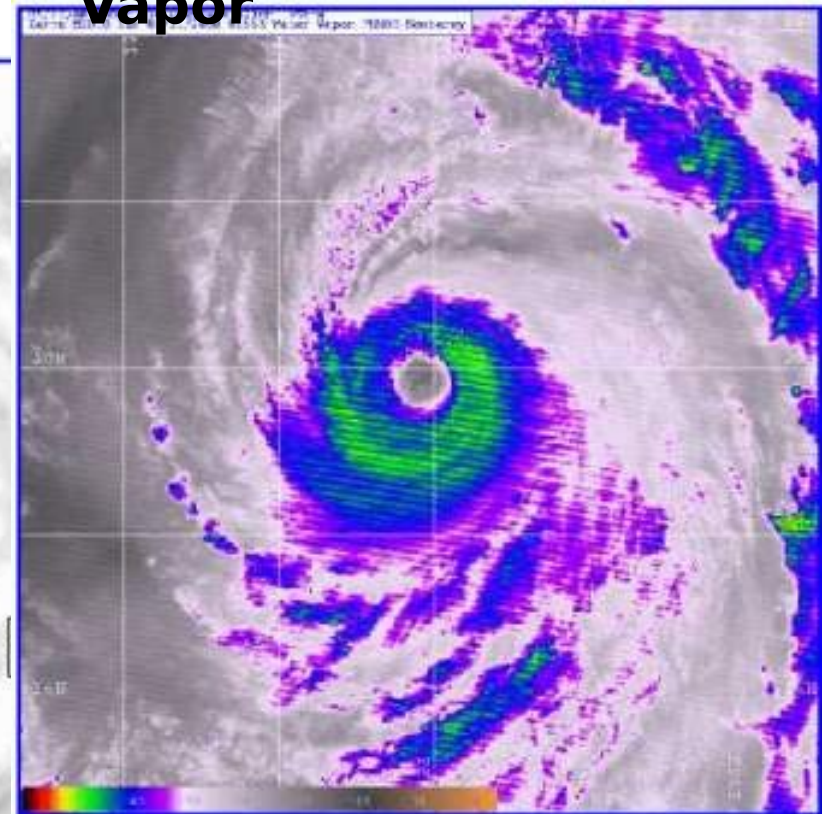
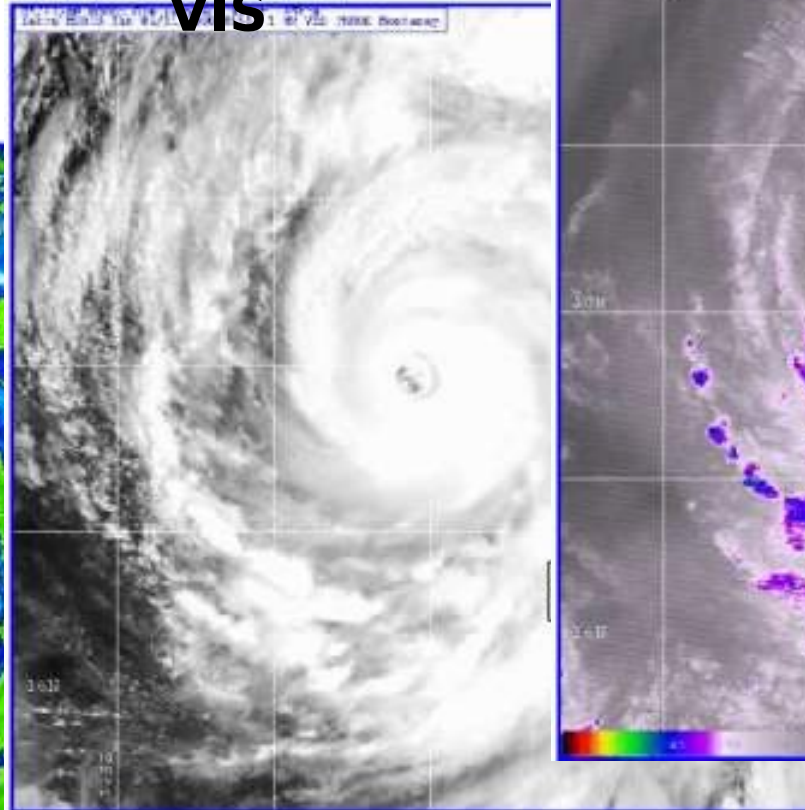
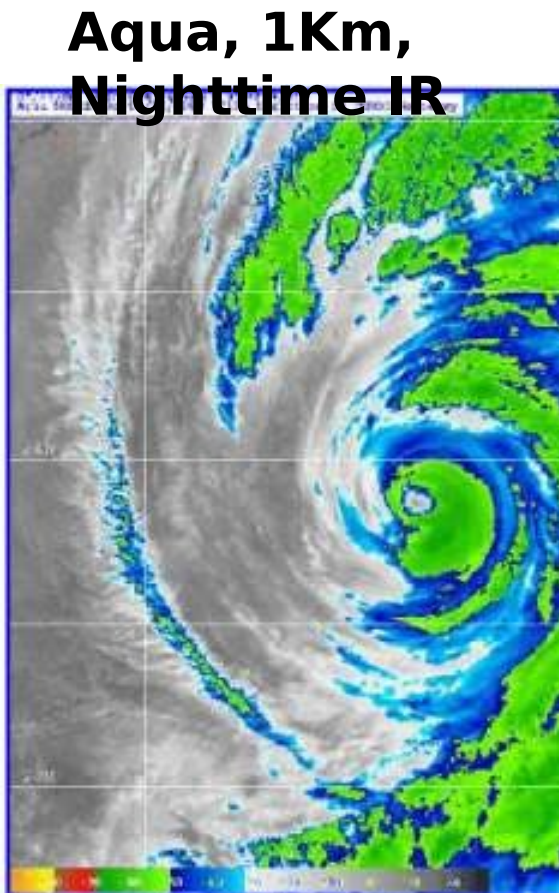


SSM/I Water Vapor



MODIS on Aqua & Terra

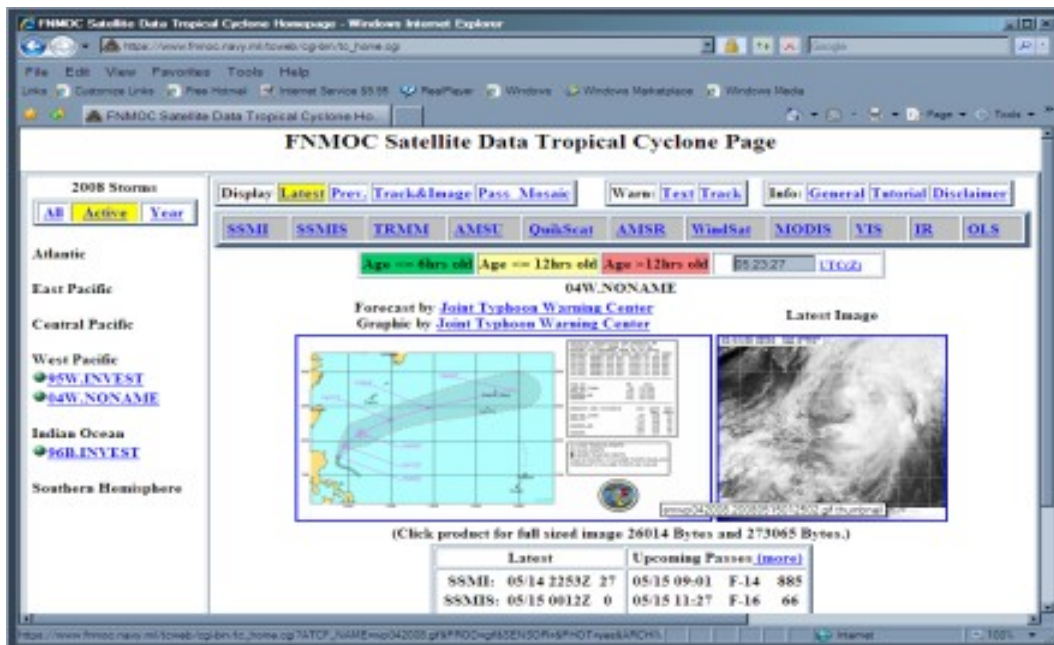
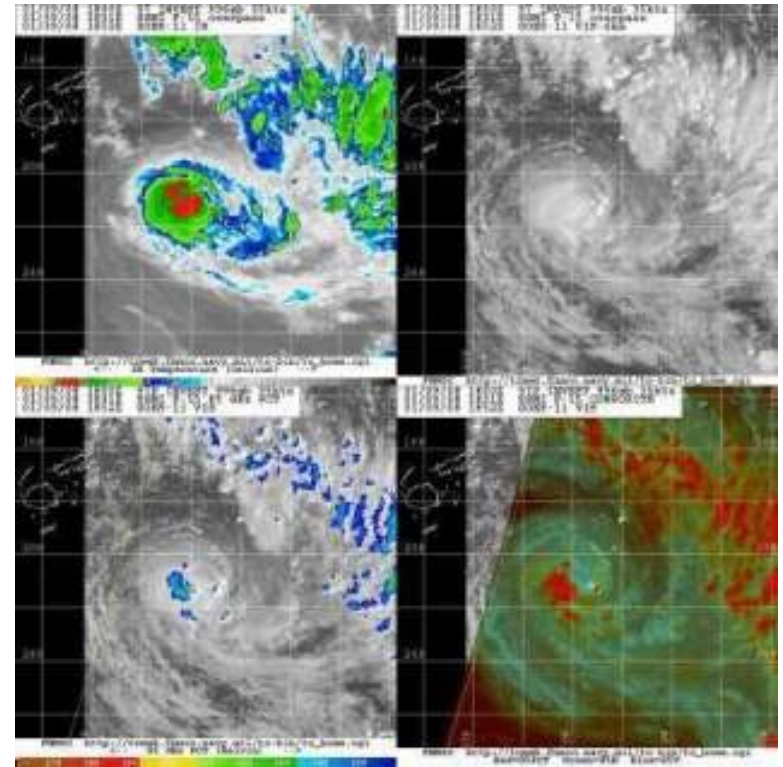
03W.RAMMASUN 11 May 2008
Terra, 1Km, VIS
Aqua, 1Km, Nighttime IR
Terra, 1Km, Water Vapor





Tropical Cyclone Web Page

- Multi-Sensor satellite data fusion page
- Complements the FNMOC TC forecast model products
- Heavily used by both military and civil forecasters
- Available to the public



Fleet Numerical...

Supercomputing Excellence for Fleet Safety and Warfighter Decision Sup



Summary

- Fleet Numerical is a 24x7 Global Operational Command, with direct support relationships and connectivity to Fleet, Joint, and Coalition Forces.
- Fleet Numerical's Core NWP Mission is aligned, resourced, and continues to maintain a World-Class reputation.
- Fleet Numerical is leaning forward in innovative and effective supercomputing combined with high-quality and pioneering METOC models and applications to deliver timely and relevant information to Forces.

***Supercomputing Excellence for Fleet Safety
And Warfighter Decision Superiority"***

